



Uncertain Decision Information Processing in Warning Systems under Group Decision Making Framework

**A thesis submitted for the degree of
Doctor of Philosophy**

By

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

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Abstract

Human factors affect the development and deployment of an effective people-centred warning system. The study of decision information processing in a complex and dynamic decision environment can be used to handle human factors efficiently.

Taking note that group decision-making is an effective processing strategy when people make decisions in a complex and dynamic decision environment, this thesis studies four aspects of decision information processing within a group decision-making framework. The four processing aspects include 1) detecting decision information inconsistency; 2) integrating decision information; 3) predicting risk using decision information; and 4) measuring decision information similarity.

Focusing on the above four processing aspects, the thesis:

- (1) Presents a rule-map technique and establishes a rule-map-based information inconsistency detection method for data inconsistency; presents a state-based domain knowledge representation technique and establishes a detection method for logical inconsistency based on this;
- (2) Presents an extended physical model as an information integration framework and establishes an information integration method based on this;
- (3) Presents a vector aggregation operator based on a complex fuzzy set framework and establishes an information prediction method for decision information with multiple periodic features;
- (4) Presents a graduate aggregation operator and establishes a measuring method for similarities among decision information.

The thesis illustrates a decision support system prototype of decision information processing in group decision-making.

Experiments indicate that the presented techniques and methods can effectively support dynamic decision information processing in a complex decision environment.

Contents

Acknowledgements	ii
Abstract.....	iv
List of Tables	xii
List of Figures	xiv
1 Introduction	1
1.1 Research Background	1
1.2 Research Objectives	5
1.3 Research Significance	6
1.4 Structure of the Thesis	7
1.5 Selected Publications Related to the Thesis	9
2 Literature Review	12
2.1 Group Decision-Making	12
2.2 Information Inconsistency Detection	14
2.2.1 Information inconsistency detection	14
2.2.2 Data inconsistency detection	16
2.2.3 Logical inconsistency detection	17
2.3 Information Integration	19
2.3.1 Aggregation operators in GDM	20
2.3.2 Linguistic methods in GDM	21

PHD Thesis, UTS	vii
2.4 Information Prediction	24
2.4.1 Multi-sensor data fusion	24
2.4.2 Uncertain information processing	25
2.4.3 Complex fuzzy sets	26
2.4.4 Multiple periodic factor prediction	28
2.5 Information Similarity Measurement	29
3 Preliminaries.....	32
3.1 Fuzzy sets and fuzzy numbers	32
3.2 Aggregation operators	35
3.3 Implication operators	38
3.4 Complex fuzzy sets	39
4 Decision Information Inconsistency Detection.....	41
4.1 Data inconsistency and logical inconsistency	41
4.2 Data inconsistency detection	42
4.2.1 Data inconsistency detection problem	42
4.2.2 A rule-map technique	42
4.2.3 A rule-map-based data inconsistency detection method	52
4.2.4 Experiments and analysis	56
4.3 Logical inconsistency detection	64
4.3.1 Logical inconsistency detection problem	64
4.3.2 State-based domain knowledge representation	64
4.3.3 An information logical inconsistency detection method	77
4.3.4 Cases study of warning information inconsistency detection	78
5 Decision Information Integration.....	83
5.1 Introduction of nuclear safeguards information management	83
5.2 The physical model and the extended physiscal model	84

5.2.1	The physical model for nuclear safeguards information	84
5.2.2	Strengths of nuclear activity indicators	84
5.2.3	The extended physical model	88
5.3	Qualitative information representation and process	89
5.4	A qualitative information integration method	90
5.4.1	An overview	90
5.4.2	Information transformation	92
5.4.3	Information integration	93
5.4.4	Aggregation operators selection	95
5.5	A case study on nuclear safeguards information for warning generation	99
5.5.1	Brief illustration and settings	99
5.5.2	Decision information transformation	101
5.5.3	Solution	102
6	Decision Information Prediction	106
6.1	Introduction	106
6.2	A product-sum aggregation operator	110
6.2.1	Complex fuzzy sets	110
6.2.2	A scale product on CFS	111
6.2.3	Constraint vector-sum of CFSs	112
6.2.4	A product-sum aggregation operator	114
6.2.5	A quasi-ordering on $\mathbb{C}_{[0,1]}$	118
6.3	A PSAO-based prediction method for MPFP problems	120
6.3.1	A formal address of an MPFP problem	121
6.3.2	The PSAOP method for MPFP the problems	121
6.4	Experiments using the PSAOP method	129
6.4.1	Annual sunspot number prediction	129
6.4.2	Bushfire warning prediction	132

6.5	Conclusions	139
7	Decision Information Similarity Measurement	141
7.1	Introduction	142
7.2	A gradual aggregation algorithm	143
7.2.1	Motivations and implementations	143
7.2.2	Weights assignment and adjustment	146
7.2.3	Dynamic decision and missing values	150
7.3	A three-level-similarity measuring method for the MOSP problem . .	151
7.3.1	The MOSP problem	152
7.3.2	Overview of the TLSM method	152
7.3.3	Measuring similarity at the Assessment-Level	154
7.3.4	Measuring similarity at the Criterion-Level	158
7.3.5	Measuring similarity at the Problem-Level	161
7.4	Case studies	162
7.4.1	Do similarities exist between social actors?	163
7.4.2	Energy policy selection with missing assessments	168
8	Prototype of a Decision Information Processing System	175
8.1	Introduction	176
8.2	A fuzzy MCGDM processing model	178
8.2.1	A typical processing model for MCGDM	179
8.2.2	Decision context and decision information	180
8.2.3	Multi-level hierarchies for evaluators and criteria	181
8.2.4	Information sources and connecting strength	182
8.2.5	A fuzzification method for objective information	183
8.2.6	A fuzzy aggregation method	184
8.2.7	Fuzzy ranking of alternatives	185

8.2.8	Summary and an example	185
8.3	DECIDER: A decision support system based on FMP model	188
8.3.1	Decision information input module	188
8.3.2	Model selection	193
8.3.3	Decision information process	193
8.3.4	Result display, comparison and analysis	193
8.4	A case study on new product development	194
8.5	Evaluations	196
9	Conclusions and Future Works.....	197

List of Tables

1.1	A short list of natural and man-made disasters 2000 – 2011	2
4.1	Period participation for 63 time slots	58
4.2	Rules for each period	58
4.3	Extracted rules of the passenger arrival example	59
4.4	Selected rules for day 20 and day 21	60
4.5	Testing result of carbon dioxide example	61
4.6	Statistical models used for the carbon dioxide experiment	62
4.7	Data rules' performance measurements (Unit: percents)	63
4.8	An example knowledge base	79
5.1	Outlines of the QII method	91
5.2	Symbols and meanings used in the QII method	92
5.3	Specific indicators of gaseous diffusion enrichment	100
5.4	Evaluation for process — gaseous diffusion enrichment	100
5.5	Synthesized possibility distributions (SPDs) for indicators	103
5.6	SPDs for the factor “especially designed equipment”	104
5.7	Synthesized possibility distributions for all factors	104
6.1	Complex-valued membership degrees of samples in 1976–1986	126
6.2	Observations and predictions about three factors	128
6.3	Example of distance measurements between y and xs (with 2 valid position)	128

6.4	Error measurements comparison	131
6.5	Fire danger rating of the Australia Bureau of Meteorology	133
6.6	Performance comparison of different amendments	138
7.1	An example for processing a missing value	151
7.2	Outlines of main processes in the TLSM method	153
7.3	Weights and their corresponding parameters of criteria (with 2 valid positions)	159
7.4	Numeric feature and parameter of similarity utility function of criteria (with 2 valid positions)	161
7.5	An illustrative example of social impact matrix	163
7.6	Similarity matrix between six social actors	164
7.7	Similarity matrix for linguistic assessments	166
7.8	Number of options with similar opinions by pairwise comparison . . .	166
7.9	Pair-wise comparison of similarity at the Criterion-Level ($f(wc) = 1$)	167
7.10	Pairwise comparison of similarity at the Criterion-Level ($f(wc) = 2$) .	167
7.11	Pairwise comparison of similarity at the Criterion-Level ($\alpha = 1/3$) . .	168
7.12	Evaluation reports of six experts	170
7.13	Symbols and Semantics of linguistic terms in evaluation reports . . .	171
7.14	Number of similar options for 16 criteria of e_1 and e_2	172
7.15	Pair-wise similarities of all six experts	174
8.1	Outlines of the FMP model	186
8.2	An example settings	187
8.3	Data types in DECIDER	190

List of Figures

3.1	Shape of commonly-used fuzzy numbers	34
4.1	The feasible degree and reliable degree of a data rule	47
4.2	A rule-map of data rules	50
4.3	An example of adjusting a rule-map	52
4.4	Main steps of the RMDID method	53
4.5	Selecting detection rules at time slot 1 and time slot 2	54
4.6	Inconsistent points under acceptable error scale 0.05	61
4.7	Inconsistent point under acceptable error scale 0.03	61
4.8	Comparison of the RMDID method and description models.	62
4.9	Covering among knowledge pieces	76
5.1	A general structure of the IAEA Physical Model	85
5.2	Possibilities of activities associated with indicators	87
5.3	An extended PM model (XPM)	89
5.4	Information integration based on XPM	92
5.5	Strengths of indicators	97
6.1	A graphic illustration of the MPFP problem	122
6.2	Example of identifying the period and CFS of sunspot numbers	124
6.3	Real observation vs. PSAOP prediction for the sunspot dataset	131
6.4	Phase value settings for the four meteorological indicators	134
6.5	Comparison of predictions by the PSAOP and a CBR method	136

7.1	The typical GAA procedure	145
7.2	Changing weights with the number of inputs	148
7.3	The dendrogram obtained by the HCFSM on similarity matrix S . . .	157
7.4	Semantic of linguistic terms	164
7.5	Dendrogram of similarities between experts	165
7.6	Dengrogram of linguistic assessments (terms)	166
7.7	Deprogram of experts using the HCFSM	174
8.1	The FMP model for fuzzy MCGDM problem	178
8.2	Example settings of a decision problem	186
8.3	Example of converting objective data to subjective data	187
8.4	Main modules in DECIDER	189
8.5	Well-being new garment products evaluation model	195
8.6	Final ranking result for new garment products under the well-being . .	195